Video Compression – HW3 (05/17/2023)

Instructions – Follow these carefully:

1. Please upload your work to Moodle. In the zip file, it must have the source code and a PDF report where you explain and display the outputs for each problem.
2. You can use either C, Python, or Matlab to do the homework work.
3. Please feel free to read related materials available in the official Matlab/Python documentation.
4. The due date is 6/1 before 11:59 pm.

In this assignment, we will use the block-based encoding approach, where the size of a block is 8x8. Only the Luma component is considered for the following questions.

1. (50%) Fourier Transform
   Please apply Fourier Transform to the luma component of "foreman_qcif_0_rgb.bmp" and demonstrate its magnitudes in a 2-D image as we shown in Page 19 of "VideoCompression_C12.pptx." Note that you need to shift the origin to the center of the image for the magnitude plot.

2. (50%) DCT
   Please apply DCT to all the 8x8 luma blocks of "foreman_qcif_0_rgb.bmp" and use the quantization matrix below for quantization. After DCT and quantization, please apply inverse quantization and IDCT to decode all the blocks and show the decoded frame.

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$$\begin{bmatrix} 16 & 11 & 10 & 16 & 24 & 40 & 51 & 61 \\ 12 & 12 & 14 & 19 & 26 & 58 & 60 & 55 \\ 14 & 13 & 16 & 24 & 40 & 57 & 69 & 56 \\ 14 & 17 & 22 & 29 & 51 & 87 & 80 & 62 \\ 18 & 22 & 37 & 56 & 68 & 109 & 103 & 77 \\ 24 & 35 & 55 & 64 & 81 & 104 & 113 & 92 \\ 49 & 64 & 78 & 87 & 103 & 121 & 120 & 101 \\ 72 & 92 & 95 & 98 & 112 & 100 & 103 & 99 \end{bmatrix}$$